which exerts an upward force or lift on the slider. The air bearing thus counter-balances the slight spring force of the suspension **215** and supports the slider **213** off and slightly above the disk surface by a small, substantially constant spacing during normal operation.

[**0033**] The various components of the disk storage system are controlled in operation by control signals generated by the control unit **229**, such as access control signals and internal clock signals. Typically, the control unit **229** comprises logic control circuits, storage chips and a microprocessor. The control unit **229** generates control signals to control various system operations such as drive motor control signals on line **223** and head position and seek control signals on line **228**. The control signals on line **228** provide the desired current profiles to optimally move and position the slider **213** to the desired data track on the disk **212**. Read and write signals are communicated to and from the read/write heads **221** by means of the recording channel **225**. Recording channel **225** may be a partial response maximum likelihood (PMRL) channel or a peak detect channel. The design and implementation of both channels are well known in the art and to persons skilled in the art. In the preferred embodiment, recording channel **225** is a PMRL channel.

[**0034**] The above description of a typical magnetic disk storage system, and the accompanying illustration of **FIG. 2** are for representation purposes only. It should be apparent that disk storage systems may contain a large number of disks and actuator arms, and each actuator arm may support a number of sliders.

[**0035**] **FIG. 3** is a side cross-sectional elevation view of a "piggyback" magnetic read/write head **300**, which includes a write head portion **302** and a read head portion **304**, the read head portion employing a spin valve sensor **306** according to the present invention. The sensor **306** is sandwiched between nonmagnetic insulative first and second read gap layers **308** and **310**, and the read gap layers are sandwiched between ferromagnetic first and second shield layers **312** and **314**. In response to external magnetic fields, the resistance of the sensor **306** changes. A sense current I_S conducted through the sensor causes these resistance changes to be manifested as potential changes. These potential changes are then processed as readback signals by the processing circuitry of the data recording channel **246** shown in **FIG. 2**.

[**0036**] The write head portion **302** of the magnetic read/write head **300** includes a coil layer **316** sandwiched between first and second insulation layers **318** and **320**. A third insulation layer **322** may be employed for planarizing the head to eliminate ripples in the second insulation layer **320** caused by the coil layer **316**. The first, second and third insulation layers are referred to in the art as an insulation stack. The coil layer **316** and the first, second and third insulation layers **38**, **320** and **322** are sandwiched between first and second pole piece layers **324** and **326**. The first and second pole piece layers **324** and **326** are magnetically coupled at a back gap **328** and have first and second pole tips **330** and **332** which are separated by a write gap layer **334** at the ABS **340**. An insulation layer **336** is located between the second shield layer **314** and the first pole piece layer **324**. Since the second shield layer **314** and the first pole piece layer **324** are separate layers this read/write head is known as a "piggyback" head.

[**0037**] **FIG. 4** is the same as **FIG. 3** except the second shield layer **414** and the first pole piece layer **424** are a common layer. This type of read/write head is known as a "merged" head **400**. The insulation layer **336** of the piggyback head in **FIG. 3** is omitted in the merged head **400** of **FIG. 4**.

FIRST EXAMPLE

[**0038**] **FIG. 5** depicts an air bearing surface (ABS) view, not to scale, of a lead overlay spin valve sensor **500** according to a first embodiment of the present invention. The SV sensor **500** comprises end regions **502** and **504** separated from each other by a central region **506**. The substrate **508** can be any suitable substance including glass, semiconductor material, or a ceramic material such as alumina (Al_2O_3). The seed layer **509** is a layer or layers deposited to modify the crystallographic texture or grain size of the subsequent layers. An antiferromagnetic (AFM) layer **510** is deposited over the over the seed layer. An antiparallel (AP)-pinned layer **512**, a conductive spacer layer **514** and a free layer **516** are deposited sequentially over the AFM layer **510**. The AFM layer may have a thickness sufficient to provide the desired exchange properties to act as a pinning layer for the AP-pinned layer **512**. In the present embodiment, the AFM layer **510** is thinner than desirable for a pinning layer and is used to provide an additional seed layer to help promote improved properties of the subsequent layers of the sensor. The AP-pinned layer **512** comprises a first ferromagnetic (FM1) layer **517** and a second ferromagnetic (FM2) layer **519** separated by an antiparallel coupling (APC) layer **518** that allows the FM1 layer **517** and the FM2 layer **519** to be strongly AP-coupled as indicated by the antiparallel magnetizations **542** (represented by the tail of an arrow pointing into the paper) and **543** (represented by the head of an arrow pointing out of the paper), respectively. The AP-coupled layer **512** is designed to be a self-pinned layer as is known to the art. The free layer **516** comprises a ferromagnetic first free sublayer **520** of Co—Fe and a ferromagnetic second free sublayer **521** of Ni—Fe.

[**0039**] A bias layer **522** separated from the free layer **516** by an APC layer **523** comprises a ferromagnetic first bias sublayer **524** of Co—Fe deposited over the APC layer **523** and a ferromagnetic second bias sublayer **525** of Ni—Fe deposited over the first bias sublayer **524**. An antiferromagnetic layer **560** of Pt—Mn, or alternatively of In—Mn, Ni—Mn or other conducting antiferromagnetic material, is deposited over the second bias sublayer **525**. The APC layer **523** allows the bias layer **522** to be strongly AP-coupled to the free layer **516**. The AFM layer **560** is exchange coupled to the bias layer **522** providing a weak pinning field to orient the direction of the magnetization **546** of the bias layer.

[**0040**] The AFM layer **560** is formed of a layer having a thickness less than needed to provide a maximum (saturated) pinning field. **FIG. 8** is a graphical representation of the variation of pinning field strength as a function of layer thickness for a typical AFM material. The pinning field increases with AFM layer thickness as the exchange coupling strength increases until a saturated or maximum pinning field is reached at a layer thickness, t_{SAT}. For an AFM layer formed of Pt—Mn, a thickness (t_{SAT}) of about 150 Å is needed to provide the maximum pinning. For an AFM layer formed of Ir—Mn, t_{SAT} is approximately 80 Å while for an AFM layer formed of Ni—Mn, t_{SAT} is approximately